

Dietary Reference Intakes: Proposed Definition and Plan for Review of Dietary Antioxidants and Related Compounds

INTRODUCTION

There has been intense interest recently among the public and the media in the possibility that increased intakes of “dietary antioxidants” may protect against chronic disease. Many research programs are underway in this area. Epidemiological evidence suggests that the consumption of fruits and vegetables may reduce the risk of both cancer and cardiovascular disease, and it has been hypothesized that this is due in part to the presence of antioxidant compounds in fruits and vegetables. As a result, these compounds have been considered together by many people and loosely termed *dietary antioxidants*.

Closer examination, however, reveals that compounds typically grouped together as dietary antioxidants can differ quite considerably from one another, both in terms of their chemical behavior and in terms of their biological properties. This report from the Institute of Medicine’s Food and Nutrition Board provides a proposed definition of dietary antioxidants so as to characterize the biological properties of these compounds.* In this first of two reports, the Panel on

*This study was requested by the federal steering committee for Dietary Reference Intakes and coordinated by the Office of Disease Prevention and Health Promotion of the U.S. Department of Health and Human Services and the U.S. Army Medical Research and Materiel Command of the U.S. Department of Defense. The overall DRI project, of which this is a part, is a comprehensive effort undertaken by the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes (DRI Committee) of the Food and

Dietary Antioxidants and Related Compounds also identifies the nutrients and food components that it will evaluate in detail, assuming adequate scientific data are available, to establish Dietary Reference Intakes (DRIs) for these selected substances.

DRIs are reference values that are quantitative estimates of nutrient intakes to be used for planning and assessing diets for healthy people. They include Recommended Dietary Allowances (RDAs) as goals for intake by individuals, but also include three other reference values. These include the Estimated Average Requirement (EAR), Adequate Intake (AI), and the Tolerable Upper Level (UL).

In its second report, the panel will provide a comprehensive set of DRIs for those nutrients and food components selected, in the current report, for detailed examination. This selection is not based on the panel's definition of a dietary antioxidant. Beta-carotene, vitamin C, and vitamin E are included as requested by the federal steering committee for Dietary Reference Intakes. Similarly, other dietary compounds will be included in the review that may be related in function, but may not necessarily act as antioxidants. Therefore, the nutritional recommendations that will be presented in the second report for some of these dietary components may not be determined by or related to their possible action as antioxidants.

TOWARD A DEFINITION OF *DIETARY ANTIOXIDANT*

In order to elicit other perspectives about the attributes of dietary antioxidants, the Panel on Dietary Antioxidants and Related Compounds held an open meeting and workshop. A broad range of definitions from experts in the field was presented (see the Appendix for Acknowledgments), however, there was no firm agreement among the presenters. The situation is complicated as some compounds, at least *in vitro*, can be antioxidants under one condition and pro-oxidants under others. Adding to the complexity is the fact that antioxidants contained in foods are not interchangeable and may differ from one another both in their sites and mechanisms of action. For example, vitamin E is a most effective chain-breaking antioxidant, whereas beta-carotene is a most effective singlet oxygen quencher. In contrast to these fat-soluble antioxidants that function in cell membranes, lipoproteins, and lipid droplets, water-soluble vitamin C directly quenches a variety of reactive oxygen and nitrogen species in the aqueous portion of cells and extracellular fluids. Selenium, not present in high enough quantities to be a direct antioxidant, participates as an essential constituent of glutathione peroxidases and thioredoxin reductase in the breakdown of peroxides, thus preventing the potentially damaging generation of reactive oxygen species.

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